This homework will require the use of the t-table of our textbook. Please show your work (write small and neat) and circle your final answer. Remember the critical z score for two tailed test with alpha 0.05 = 1.96 and is 2.58 if alpha = 0.01

For questions 1 & 2 please assume a z-distribution with a mean of 30 and a standard error of the mean (sem) of 2.

1. Find the confidence interval for a 95% confidence level. 
   *Start by filling in the desired information on curve 1 (to the right)*

2. Find the confidence interval for a 99% confidence level. 
   *Start by filling in the desired information on curve 2 (to the right)*

3. Mark and Melvin work inside Intel’s semiconductor fabrication plants. The environment is highly controlled so that the manufactured chips are not contaminated. In these “clean rooms” the workers wear "bunny suits” to keep themselves from contaminating the process. Mark and Melvin are each assigned a different team to measure the workers. Both teams measure the same sample of 100 workers and determine the very specific dimensions of their “bunny suits”. Mark spends a week training his team of data collectors, providing identical tape measures and creating a strict protocol for measuring the workers. Melvin however, simply sends out his team to measure the workers, with little instruction. Remember, both teams measure the same sample of 100 workers. Turns out, the data from Mark’s team are more reliable and contain few errors, while the data from Melvin’s team contain many more errors and are generally sloppy. Please compare these two distributions:

   a) which distribution would be more variable? 
   *(label two curves at right – as Mark or Melvin’s distribution)*

   b) please describe for this situation, which of these things affect the difference in variability between the two groups
      1. could it be due to differences in sample size?
      2. could it be due to differences in variability in the population?
      3. could it be due to differences in the random error (noise) in sample

   c) If a 95% confidence interval was constructed for these two distributions, which would have a larger interval? – why? *(draw the 95% confidence intervals on the two curves at right)*
This is a “quality control” problem. Your grocery store sells 5-pound bags of whole potatoes. You know that there will be variability; some bags will weigh more than others. You also know that you will lose profits if the bags weigh too much, but it would be illegal if the bags weighed too little. The population mean across all stores is 5 pounds and the population standard deviation is 1 pound. You want to know whether the bags of potatoes coming out of a particular plant are too heavy or too light. So you take a sample of 16 bags and you find the average weight of that sample is 6 pounds. You want to know if this is a significant difference ($\alpha = .05$).

Please answer the following questions:

a) Would you use a z-test or a t-test for this hypothesis test?  
   (Hint: do you know the population variability?)

b) State the null hypothesis and state the alternative hypothesis
   null: 
   alternative: 

c) Would you use a one-tailed or two-tailed hypothesis test?  
   (Hint: do you want to know about any difference or just a “less than” or “greater than” sort of difference)

d) What would your critical z-score be?

\[
\sigma_x = \frac{\sigma}{\sqrt{n}} \\
z \text{ score } = \frac{\bar{x} - \mu}{\sigma_x}
\]

e) Calculate your z score:

f) Given that your critical z is 1.96 and your observed z is 4.0, describe your decision:  
   Would you reject the null?  
   Is this a significant difference?  
   Is $p < 0.05$?  
   What is the probability of a Type I error?

f) If this were a one-tailed test, what would the critical z score be?  
   Would this have made a difference in terms of our decision?  
   Why?

h) If this were a test with alpha of 0.01 (two tailed), what would critical z be?  
   Would it have made a difference in terms of our decision?  
   Why?

i) Describe what a Type I and Type II error would be in this case  
   “Type I error would be concluding ___________________ when in fact ___________________.”  
   “Type II error would be concluding ___________________ when in fact ___________________.”

j) You would use a z score of ______ to construct a 95% confidence interval, and a z-score of ______ to construct a 99% confidence interval
5. Your workers in one store appear to be disgruntled and unhappy. You know this because you
designed a job-satisfaction questionnaire and gave it to all of your employees, and the mean job-
satisfaction score for the whole population was only 85 (out of 100). You’re trying to decide
whether to hire consultant to affect morale. So, to test whether you should hire her, you send a
sample of 16 workers on a weekend retreat with her and when they return they fill out a similar
job-satisfaction questionnaire. This sample of 16 workers scored an average of 89 on the
questionnaire, with a sample standard deviation of 6. You do not know the standard deviation of
the population. You want to know if these workers score differently on job satisfaction than
workers in your other stores. You want to test for a significant difference ($\alpha = .05$).
Please answer the following questions:
a) Would you use a z-test or a t-test for this hypothesis test?
(Hint: do you know the population standard deviation?)

__________________

b) Would you use a one-tailed or two-tailed hypothesis test?
(Hint: do you want to know about any difference or just a “less than” or “greater than” sort of difference)

__________________

c) What is your alpha level for this problem?

__________________

d) What would your degrees of freedom be?

__________________

e) What would your critical t-score be?
(Please note: the t-table to use in finding your critical t-score can be found on page 384 of our textbook (Ha and Ha book)

f) Calculate your t score:

$\frac{X-\mu}{S} \sqrt{n}$

\[ t = \frac{\bar{X} - \mu}{S} \sqrt{n} \]

g) Given that your critical t is 2.131, and your observed t is 2.667, describe your decision:

Would you reject the null? __________________________

Is this a significant difference? __________________________

Is p < 0.05? __________________________

What is the probability of a Type I error? __________________________

h) If this were a one-tailed test, what would the critical t score be? __________

Would this have made a difference in terms of our decision? __________

Why? __________________________

i) If this were a test with alpha of 0.01 (two tailed), what would critical t be? ______

Would it have made a difference in terms of our decision? __________

Why? __________________________

Would you reject the null? __________________________

Is this a significant difference? __________________________

Is p < 0.01? __________________________

j) Describe what a Type I and Type II error would be in this case

"Type I error would be concluding __________________________ when in fact __________________________."

"Type II error would be concluding __________________________ when in fact __________________________."

k) You would use a t-score of ________ to construct a 95% confidence interval, and a
t-score of ________ to construct a 99% confidence interval
The mean response time for following the sheriff’s new plan was 24 minutes, while the mean response time prior to the new plan was 30 minutes. A t-test was completed and there appears to be no significant difference in the response time following the implementation of the new plan $t(9) = -1.71$; n.s.

Remember, the first couple of sentences introduced the independent and dependent variables, and group means. The next section describes the test used and the findings of the test. The last part uses statistical notation to summarize the findings.

Please construct a brief (one paragraph) summary of your results of the “bags of potato” problem using this format. The “bags of potato” problem is problem 4 (above). Please use the two-tailed test of significance with an alpha of .05.

Please construct a brief (one paragraph) summary of your results of the “disgruntled employees” problem using this format. The “disgruntled employees” problem is problem 5 (above). Please use the two-tailed test of significance with an alpha of .05.